Space Weather Technical Forecast

Issued on Monday, 11 April 2022 at 01:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor Geomagnetic Storms, mainly at first on day 1 and on day 3.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with a C-flare from AR2978. There is now one sunspot region on the Earth-facing disc, as AR2978 and AR2981 have both rotated off the southwest limb. The remaining region AR2983 is small and simple. A large filament in the southwest of the disc lifted off on 9th Apr. The associated CME has been analysed, with the bulk of the ejecta travelling below Earth's orbit, but looks like it might have an Earth directed component.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, was indicative of weak CME effects and a HSS arrival through the overnight period UTC. Solar winds have been slightly elevated to elevated peaking at 537 km/s at 10/1352 UTC. The density fluctuated between above average and average levels throughout peaking at times above 20 ppcc. The interplanetary magnetic field (IMF) strength, Bt, was Moderate with Strong interval between 10/0000-10/0400 UTC. The north-south component, Bz, ranged between +17/-1 nT, with the most notable switch to southward direction between 10/0200-0900 UTC. The Phi angle also made a notable switch from positive (away from the Sun) to negative (towards the Sun) shortly after 10/0200 UTC. Geomagnetic activity was largely Quiet to Active (Kp 2-4) with two Moderate Geomagnetic Storm intervals (Kp 6) between 0300-0900 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES-16 at GEO was at background levels. The high energy (greater than 2MeV) electron flux was mostly at normal background, with brief spells reaching moderate levels. The corresponding 24-hour fluence was on a slight increasing trend, with 4.02e6 integrated pfu observed at 11/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low, with only one small and simple sunspot on the disc. There is a Slight Chance (5-10%) for further C-class flares through the forecast period.

Solar Wind / Geomagnetic Activity: Current HSS effects from CH72 may be enhanced by a CME arrival early on Day 1 (11 Apr). Timing of this feature is uncertain, but combined CME and HSS effects are likely to continue with slightly elevated solar winds continuing. A further CME is possible late on Day 3 or early Day 4 (12/13 Apr) originating from a filament eruption on 09 Apr. Geomagnetic activity is likely to be Quiet to Unsettled, becoming Active (Kp4) at times with a Chance of G1/minor geomagnetic storms (Kp5) , especially at first on Day 1 and during Day 3.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is

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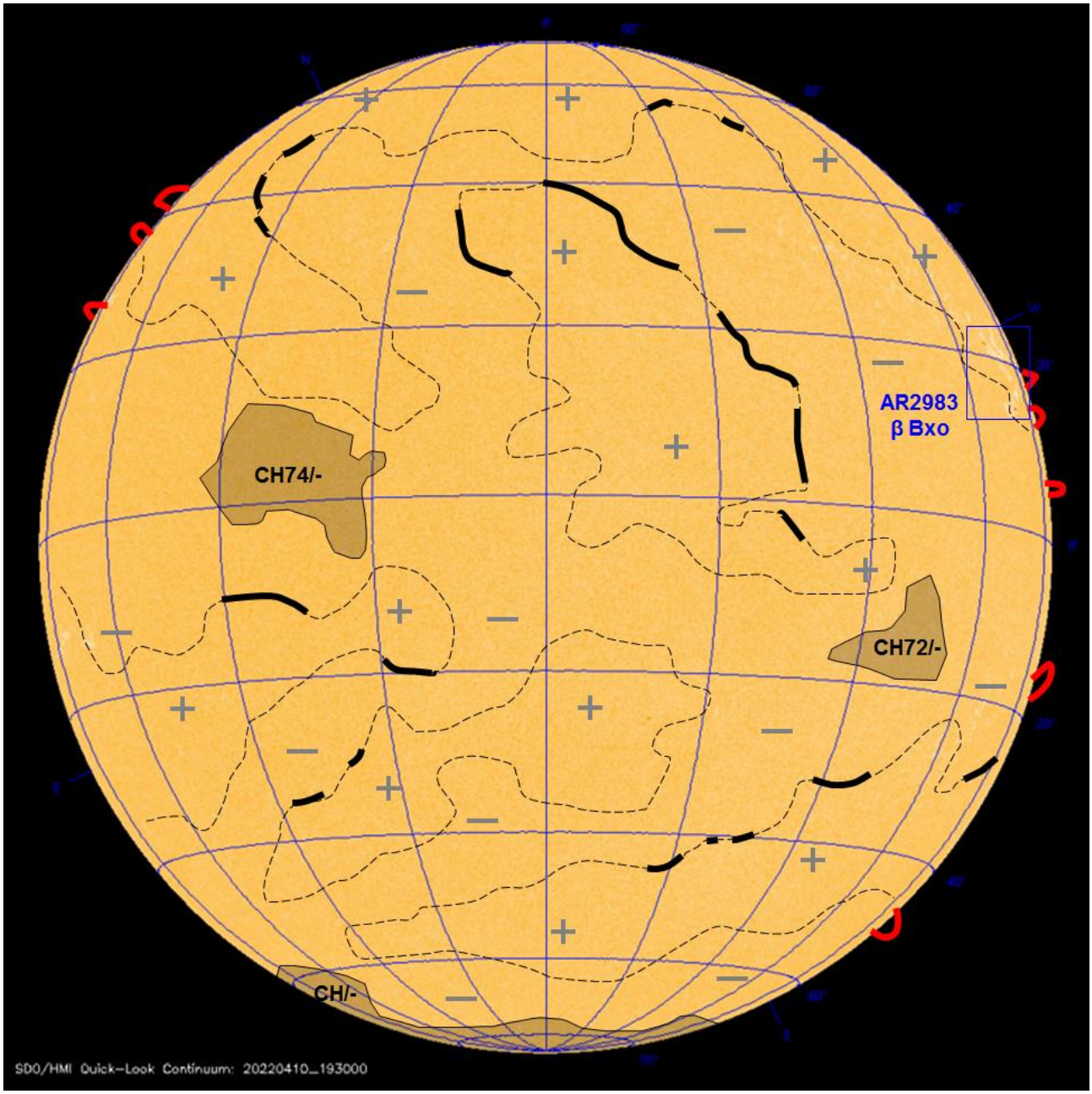
expected to persist at background levels. The high energy (greater than 2 MeV) electron flux is forecast to start at background levels, perhaps rising to peak at High levels on Days 1 and 2 (11-12 Apr), before a further CME arrival is likely to suppress levels for a short spell on Day 3 (13 April). The associated 24 hour fluence is likely to remain below the Active threshold throughout the period, but may approach the threshold later on Day 3 and more likely during Day 4 (4 April)..

Figure 1. Solar Analysis Valid 2000UTC, 10 April 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Current HSS effects from CH72/73/- may be enhanced by a CME arrival early on Day 1 (11 Apr). Timing of this feature is uncertain, but combined CME and HSS effects are likely to maintain the solar wind at a slight elevated level. A further CME originating from a filament eruption on 09 Apr may have an Earth directed component. This CME was largely southward directed, but there appears to be some ejecta earthbound on LASCO C2/C3 imagery, and ENLIL depicts a glancing blow. The arrival is currently anticipated to arrive either late on Day 2 (12 Apr) or more likely during Day 3 (13 Apr).

Geomagnetic activity is forecast to be Quiet to Unsettled with a 40% Chance of G1/Minor Storms at first on Day 1 (11 April) and also either later on Day 2 (12 April) or during Day 3 (13 April) due to the impacts from the further possible CME arrival.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	40	40	50	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
07/1317	Partial	Filament	SE	416	09/2100	Chance of G1
09/2010	Partial	Filament	SW	500	13/0100	Glancing blow possible

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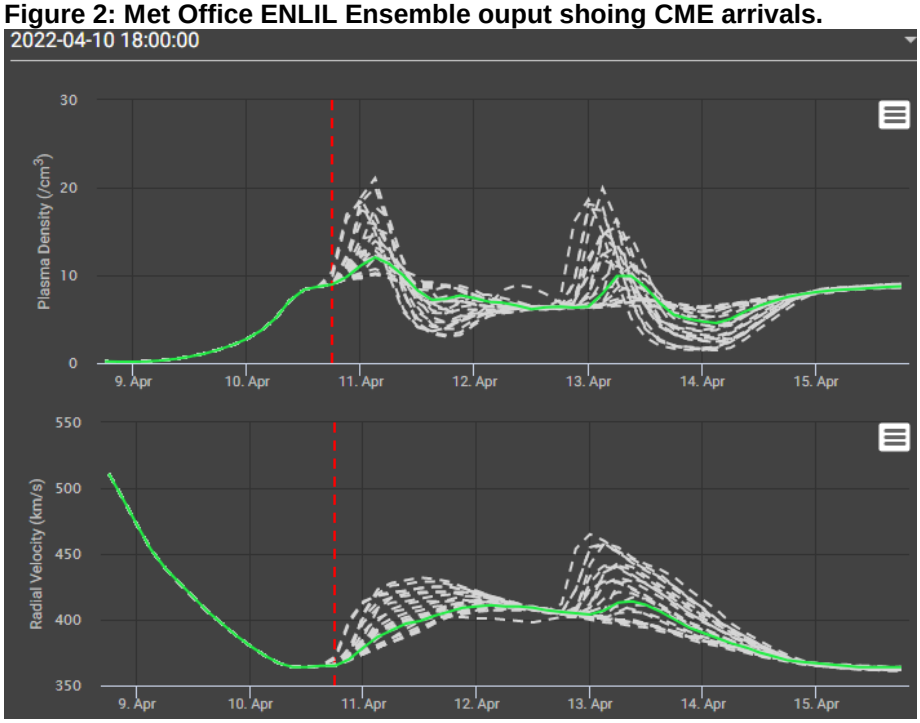
Figure 2: Met Office ENLIL Ensemble ouput shoing CME arrivals.



Radio Blackouts - X-Ray Flares:

There is now one sunspot region on the Earth-facing disc AR2983, and this appears from available imagery to be relatively simple and inactive. C-class activity in the past 24 hours has mainly originated from AR2978 which has now rotated over the southwest limb, along with AR2981. AR2978 still contributes to the flare probability until it is further past the southwest limb. The remaining region is AR2983 (Cro/Beta) which is small and simple carries low flare risks. Overall, activity has been Low, with one C-flares from AR2978. Low activity is expected to become Very Low as AR2978 rotates further off the disc. One further possible region may rotate onto the southeast limb in the coming days, but it doesn't currently look particularly active in STEREO-A imagery.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

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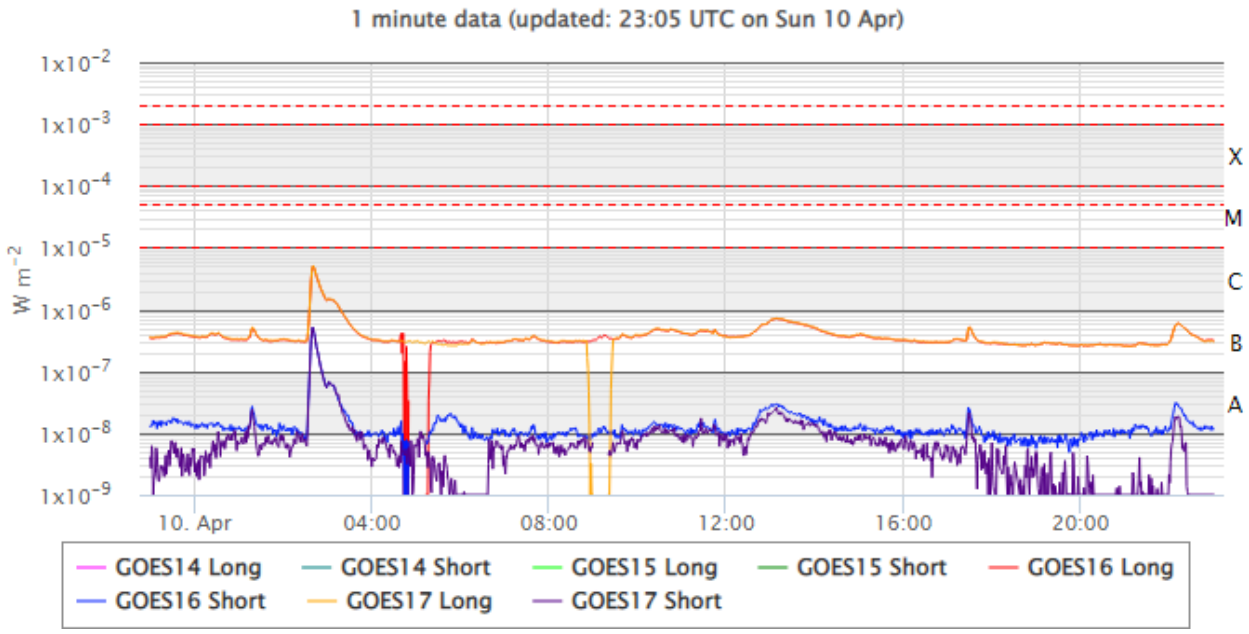
Figure 3: X-ray flux plot at GEO showing one C-class flare in past 24 hours.



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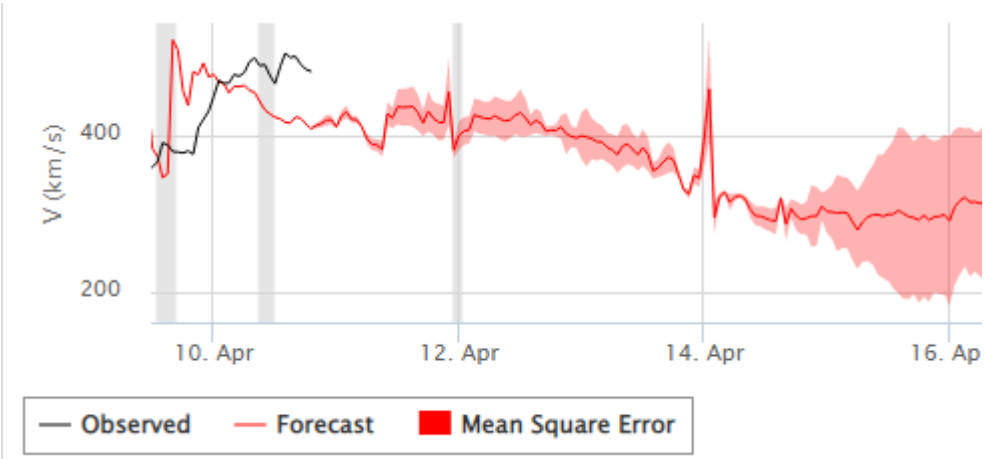
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background and in the absence of complex sunspots on the Earth-facing disc is expected to remain at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office Solar Winds Prediction Model (SWPM).



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High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV), as observed by GOES-16 at GEO, has remained mostly at normal background through the last 24 hours. Recent CME arrivals and a likely HSS arrival is expected to keep flux levels suppressed at first, before a possible rise in response to the HSS. Flux may peak at High levels during this time, before a further possible CME arrival late on Day 2 or early Day 3 (12/13 Apr) may suppress flux levels for a short spell. The associated 24 hour fluence is below the Active (1e8 integrated pfu) threshold and is likely to remain below through the forecast period, although a rising trend is probable on Days 1 and 2. A decline is then likely for a spell on Day 3 in response to possible CME effects before a resumption in the upward trend. Met Office REFM output will not be taking account of CME effects, or the HSS as this is a non-recurrent feature, and model output may not be giving reliable guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	20	30	20	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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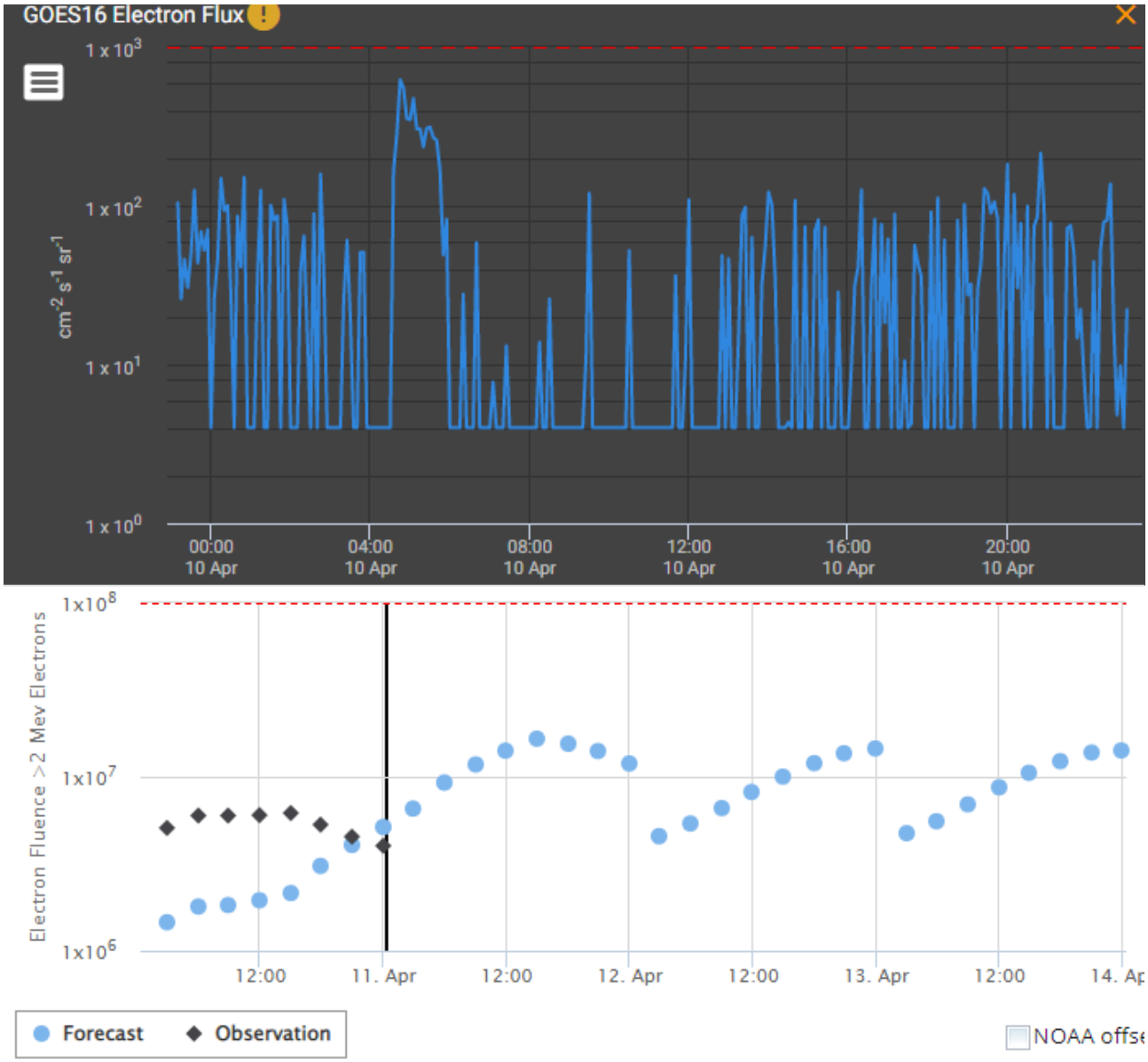
Figure 5: High energy electron flux at GEO and Met Office REFM output.



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